# Haruki HIRABAYASHI:* **Chromosome numbers in several species of the Aspidiaceae (2)**

平林春樹*: オシダ科数種の染色体数 (2)

As a continuation of the previous report2), the chromosome numbers in 43 taxa of the Aspidiaceae are reported, 22 being confirmations and 21 being initial counts. The taxa employed and the gametic chromosome numbers counted are listed in Table 1.

## Observations and discussion

*Athyrium.* Five native hybrids in this genus are investigated cytologically. All were tetraploid hybrid. Table 2 shows the results of cytological observation and the putative parents of these hybrids that have been proposed by Kurata8)9)10)11)12). As may be seen in this table, the hybridity of each hybrid is supported cytologically. It should be noted that two of the 5 hybrids, namely *A. cornopteroides* and *A. petiolulatum,* are thought by Kurata to be an intergeneric hybrid between the genera *Athyrium* and *Cornopteris.* It was detected that *A. melanolepis* and *A. nikkoense* are basic sexual diploid species. And it was found that the following six taxa are sexual tetraploids, namely *A. arisanense, A. eremicola*6), *A. kenzo-satakei*5), *A. oblitescens*15), *A. vidalii* form. *viridans*14) and *A. yakusimense.*

*Cornopteris.* For this genus, the previous paper has been published by Kurita16). It seems that *C. hakonensis* is a triploid hybrid, since it shows approximately 40 bivalents and 40 univalents and yields abortive spores. This result of observation agrees with the previous report. Besides it is possible that the chromosomal behaivor of 'n' pairs and 'n' singles suggests the possibility of autopolyploid relationship between hybrid and its parents.

*Cyrtomium.* Three taxa observed were apogamous triploids. Of these, *C. fortunei* var. *intermedium* shows diploid and triploid phases at meiosis in the same individual. It seems that this phenomenon couples with the spe-

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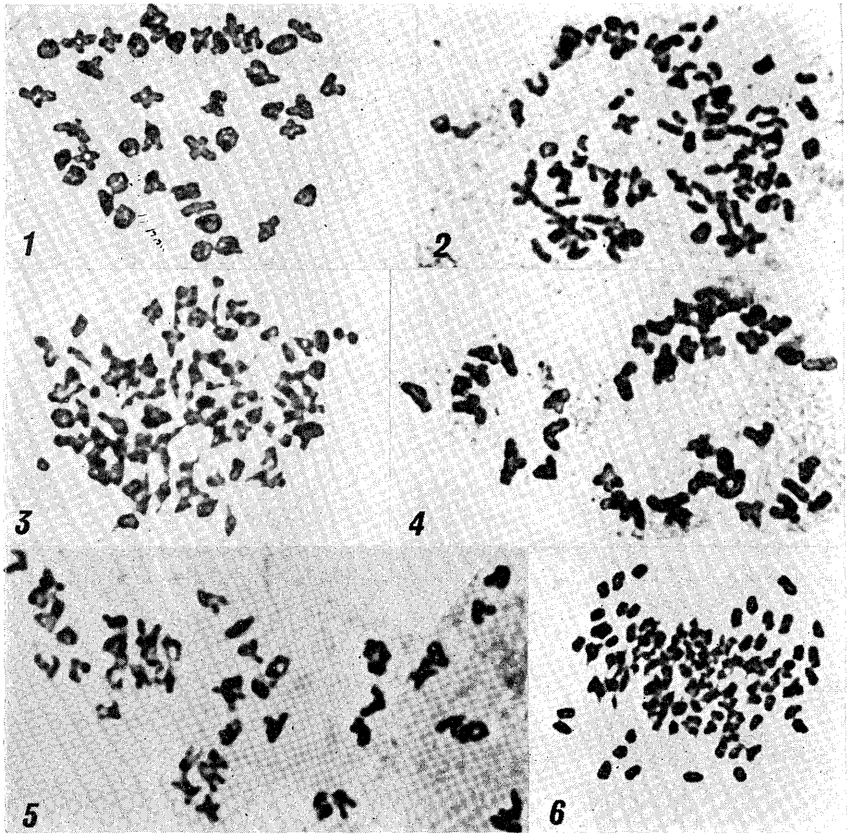


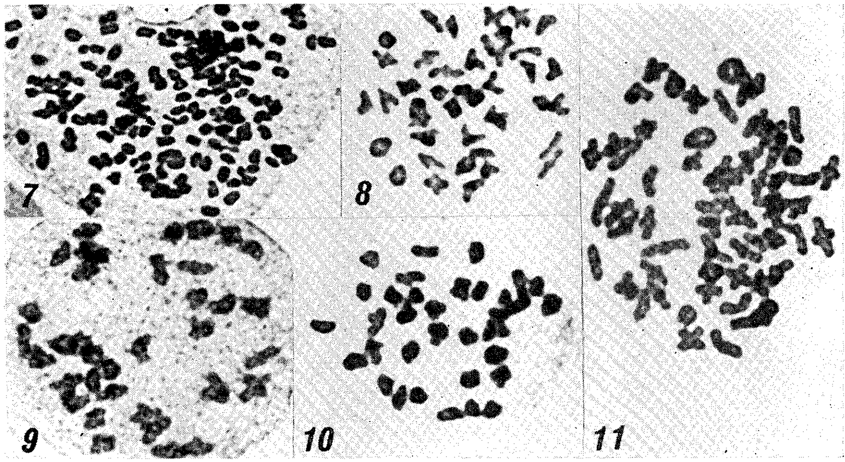
Figs. 1–6. Chromosomes at meiosis. 1. *Acrophorus stipellatus* n=41. 2. *Athyrium* ×*akiense* n=160/2. 3. *A. cornopteroides* n=ca. 160/2. 4. *A. melanolepis* n=40. 5. *A. spinulosum* n=40. 6. *Lunathyrium* ×*kiyozumianum* n=120/2. All ca. ×1000.

cific nature of apogamous ferns as described previously in *Dryopteris*1).

*Diplazium*. *D. heterophlebium* and *D. okudairai* each was determined as a basic sexual diploid species.

*Leptogramma*. It was detected that *L. totta* form. *pilosissima*3)4) is the same sexual diploid as the basic species *L. totta* is.

*Lunathyrium*. It was found that *L. otomasui*7) and *L. pterorachis* are basic sexual diploid species. Of two apogamous triploids, *L. okuboanum* and *L. unifurcatum*, in the former the diploid and triploid phases were



Figs. 7–11. Chromsomes at meiosis. 7. *Athyrium*×*pygmaei-silvae* n=160/2. 8. *Ctenitopsis sinii* n=41. 9. *Leptogramma totta* form. *pilosissima* n=36. 10. *Thelypteris quelpaertensis* n=36. 11. *T. nipponica* n=62. All. ca. ×1000.

observed at the meiosis in the same individual. Therefore it may be said that the presence of two phases at meiosis in apogamous ferns applies not only to *Dryopteris* but to *Cyrtomium* and *Lunathyrium*. *L.*×*kiyozumianum*13) was a triploid hybrid, showing approximately 13 pairs and 94 singles and producing exceedingly abortive spores. For the putative parents of this hybrid, *L. henryi* and *L. pycnosorum* have been proposed by Kurata13). For *L. pycnosorum*, the numbers n=8017) and n=4019) are given, but for *L. henryi* is not known.

*Thelypteris*. It was detected that *T. quelpaertensis* is a sexual diploid with n=36 and *T. nipponica* is a sexual tetraploid with n=62. In the genus *Thelypteris*, on the whole, two distant base numbers, x=36 and x=31 are present. Table 3 shows the chromosome numbers in Japanese species of the genus counted until the present. As obvious from this table, the genus is composed of two groups of x=36 and 31. Manton18) investigated the chromosome numbers in *Thelypteris* of Ceylon and obtained the results as shown in Table 4. And she described that the cytology indicates that generic separation is probably advisable for the group of species containing *T. pyrrorachis*, *uliginosa* and *beddomei*. It seems that this description is applicable also to the Japanese *Thelypteris*.

Table 1. Chromosome numbers in several species of the Aspidiaceae.

| Taxon | Locality | n | Ploidy & Hybrid | Fig. | Previous report |
|---|---|---|---|---|---|
| *Acrophorus stipellatus* (Taiwanhimewarabi) | Yakusima, Kagosima Pref. | 41 | 2x | 1 | n=41 (Verma 1958, M.** 1967) |
| *Arachniodes pseudo-aristata* (Kobanokanawarabi) | Owase, Mie Pref. | 41 | 2x | — | n=41 (K.** 1966) |
| *A. standishii* (Ryomensida) | Antaroma, Hokkaido | 41 | 2x | — | n=41 (M. 1965) |
| *Athyrium* × *akiense* (Akiinuwarabi) | Kanagokei, Yamaguti Pref.* | 160/2 (meiosis irreg.) | hybr. | 2 | — |
| *A. arisanense* (Arisan-inuwarabi) | Kusenbu, Saga Pref.* | 80 | 4x | — | — |
| *A. brevifrons* (Ezomesida) | Osorezan, Aomori Pref.* | 40 | 2x | — | n=40 (M. 1965) |
| *A. cornopteroides* (Siketiinuwarabi) | Yakusima, Kagosima Pref.* | ca. 160/2 (meiosis irreg.) | hybr. | 3 | — |
| *A. eremicola* (Heikeinuwarabi) | Suzunootaniyama, Simane Pref.* | 80 | 4x | — | — |
| *A. filix-femina* (Seiyomesida) | * | 40 | 2x | — | n=40 (Manton 1950) |
| *A. kenzo-satakei* (Sibiinuwarabi) | Sibisan, Kagosima Pref.* | 80 | 4x | — | — |
| *A. melanolepis* (Miyamamesida) | Kobusigatake, Nagano Pref. | 40 | 2x | 4 | — |
| *A. mesosorum* (Nuriwarabi) | Takaosan, Tokyo Pref. | 40 | 2x | — | n=40 (K. 1960, M. 1968) |
| *A. nikkoense* (Iwainuwarabi) | Kogasisan, Totigi Pref.* | 40 | 2x | — | — |
| *A. nipponicum* (Inuwarabi) | Uenohara, Yamanasi Pref. | 40 | 2x | — | n=40 (K. 1960), n=80/2 (K. 1967) |
| *A. oblitescens* (Sakimoriinuwarabi) | Kinkeidaki, Yamaguti Pref.* | 80 | 4x | — | — |
| *A. petiolulatum* (Inusiketiinuwarabi) | Yakusima, (type stock) Kagosima Pref.* | ca. 160/2 (meiosis irreg.) | hybr. | — | — |
| *A.* × *pygmaei.silvae* (Kobitoinuwarabi) | Yakusima, Kagosima Pref.* | 160/2 (meiosis irreg.) | hybr. | 7 | — |
| *A. spinulosum* (Miyamainuwarabi) | Yatugatake, Yamanasi Pref. | 40 | 2x | 5 | n=40 (M. 1965) |
| *A. vidalii* form. *viridans* (Midoriyamainuwarabi) | Kusenbu, Saga Pref.* | 80 | 4x | — | — |
| *A. wardii* (Hirohainuwarabi) | Kyusyu* | 80 | 4x | — | n=80 (K. 1960) |
| *A. yakusimense* (Yakusimataniinuwarabi) | Yakusima, Kagosima Pref.* | 80 | 4x | — | — |

|  |  |  |  |  |  |
|---|---|---|---|---|---|
| *A.* × *yaku-insulare*<br>(Yakusibiinuwarabi) | Yakusima,<br>Kagosima Pref.* | 160/2<br>(meiosis irreg.) | hybr. | — | —— |
| *A. yokoscense*<br>(Hebinonegoza) | Yatugatake,<br>Yamanasi Pref. | 40 | 2x | — | n=40 (K. 1960) |
| *Cornopteris decurrenti-alata*<br>(Siketisida) | Arisan,<br>Taiwan | ca. 80 | 4x | — | n=80 (K. 1964, M. 1968) |
| *C. hakonensis*<br>(Hakonesiketisida) | Mitake,<br>Tokyo Pref.* | 120/2<br>(meiosis irreg.) | hybr. | — | n=120/2 (K. 1964, M. 1968) |
| *C. opaca*<br>(Arisansiketisida) | Yakusima,<br>Kagosima Pref.* | ca. 80 | 4x | — | n=41, c. 82 (K. 1964) |
| *Ctenitopsis sinii*<br>(Satumasida) | Kumamoto Pref.* | 41 | 2x | 8 | n=41 (K. 1965) |
| *Cyrtomium fortunei*<br>(Yabusotetu) | Hakone,<br>Kanagawa Pref. | '123' | 3x | — | n='123' (K. 1960, M. 1968) |
| *C. fortunei* var. *intermedium*<br>(Miyakoyabusotetu) | Kagosima Pref.* | '123'<br>(2 phases) | 3x | — | n='123' (M. 1968) |
| *C. macrophyllum*<br>(Hirohayabusotetu) | Kosyosan,<br>Hukuoka Pref.* | '123' | 3x | — | n='123' (K. 1967) |
| *Diplazium heterophlebium*<br>(Zyakosida) | Yakusima,<br>Kagosima Pref.* | 41 | 2x | — | —— |
| *D. okudairai*<br>(Iyokuzyaku) | Naidaizin,<br>Kumamoto Pref.* | 41 | 2x | — | —— |
| *D. pin-faense*<br>(Hukuregisida) | Satumagori,<br>Kagosima Pref.* | 41 | 2x | — | n=41 (K. 1965) |
| *Leptogramma totta* form. *pilosissima*<br>(Aragemizosida) | Yahatano,<br>Sizuoka Pref.* | 36 | 2x | 9 | —— |
| *Lunathyrium* × *kiyozumianum*<br>(Kiyosumimesida) | Osino,<br>Yamanasi Pref.* | 120/2<br>(meiosis irreg.) | hybr. | 6 | —— |
| *L. okuboanum*<br>(Oohimewarabi) | Takaosan,<br>Tokyo Pref. | '120'<br>(2 phases) | 3x | — | n='120' (K. 1960, M. 1968) |
| *L. otomasui*<br>(Asosikesida) | Kukino,<br>Kumamoto Pref.* | 40 | 2x | — | —— |
| *L. pterorachis*<br>(Oomesida) | Myokosan,<br>Niigata Pref.* | 40 | 2x | — | —— |
| *L. pycnosorum* var. *vegetius*<br>(Miyamasikesida) | Myokosan,<br>Niigata Pref.* | 40 | 2x | — | n=80 (K. 1960), n=40 (M. 1966) |
| *L. unifurcatum*<br>(Oohimewarabimodoki) | Kanagokei,<br>Yamaguti Pref.* | '120' | 3x | — | n='120' (M. 1965, K. 1966) |
| *L. viridifrons*<br>(Midoriwarabi) | Tiba Pref.* | 40 | 2x | — | n=40 (K. 1963, M. 1966) |
| *Thelypteris quelpaertensis*<br>(Oobasyorima) | Aizankei,<br>Hokkaido | 36 | 2x | 10 | —— |
| *T. nipponica*<br>(Nikkosida) | Huzisan,<br>Yamanasi Pref.* | 62 | 4x | 11 | —— |

* The specimen cultivated in Koishikawa Botanical Garden of Univ. of Tokyo.

** Initials of author's name. M: Mitui, K. K: Kurita, S.

Table 2. Cytological data and putative parents of five native hybrids in *Athyrium*.

| Hybrid name*** | Putative parents | Author | Paring behavior observed |
|---|---|---|---|
| *A.*×*akiense*<br>(2n=160) | *A. eremicola* (n=80*)<br>×*A. otophorum* (n=80**) | Kurata<br>(1966) | ca. $60_{\mathrm{II}}$+ca. $40_{\mathrm{I}}$ |
| *A. cornopteroides*<br>(2n=ca. 160) | *A. arisanense* (n=80*)<br>×*Cornopteris opaca* | Kurata<br>(1963) | ca. $11_{\mathrm{IV}?}$+ca. $25_{\mathrm{II}}$<br>+ca. $66_{\mathrm{I}}$ |
| *A. petiolulatum*<br>(2n=ca. 160) | *A. yakusimense* (n=80*)<br>×*Cornopteris opaca* form. *glabrescens* (n=41, ca. 82**) | Kurata<br>(1965) | ca. $42_{\mathrm{II}}$+ca. $76_{\mathrm{I}}$ |
| *A.*×*pygmaei-silvae*<br>(2n=160) | *A. arisanense* (n=80*)<br>×*A. tozanense* | Kurata<br>(1961) | ca. $1_{\mathrm{II}?}$+ca. $158_{\mathrm{I}}$ |
| *A.*×*yaku-insulare*<br>(2n=160) | *A. kenzo-satakei* (n=80*)<br>×*A. yakusimense* (n=80*) | Kurata<br>(1965) | ca. $50_{\mathrm{II}}$+ca. $60_{\mathrm{I}}$ |

* Number counted in the present study.
** No. reported by Kurita (1960, 1964) and Mitui (1966).
*** All hybrid species were abortive spore formation.

Table 3. Chromosome numbers in Japanese *Thelypteris*.

| x=36 | x=31 |
|---|---|
| *T. erubescens* Ching n=36[17] & 72[19] | *T. angulariloba* Ching n=c. 62[19] |
| *T. glanduligera* Ching n=72[19] | *T. beddomei* Ching n=31[2] |
| *T. laxa* Ching n=72[17] | *T. japonica* Ching n=62[17] & 93/2[19] |
| *T. quelpaertensis* Ching n=36 | *T. japonica* var. *musashiensis* Hiyama n=31[19] |
| *T. palustris* Schott n=36[2] | *T. nipponica* Ching n=62 |
| *T. subochthodes* Ching n=36[2][19] | *T. oligophlebia* var. *elegans* Ching n=31[2] & 62[19] |
| (*T. omeiensis* Ching n=c. 136[17][19]) | *T. uraiensis* Ching n=62[2] |
|  | *T. viridifrons* Tagawa n=c. 62[17] |

Table 4. Chromosome counts in *Thelypteris* of Ceylon (Manton 1953).

| | |
|---|---|
| *T. xylodes* n=c. 36 | *T. pyrrorachis* n=62 & 93 |
| *T. ciliata* n=36 | *T. uliginosa* n=62 |
| *T. flaccida* n=35 & 70 | *T. beddomei* n=31 |

The author wishes to express his cordial thanks to Prof. H. Ito, Tokyo University of Education, for his helpful guidance and suggestion and to Prof. S. Kurata, University of Tokyo, for his valuable advice and for his kindness of providing the facilities for this investigation.

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オシダ科に属する43種類のシダの染色体数を調べ次のような結果を得た。

1. メシダ属： 倉田博士によりはじめて記載されたアキイヌワラビ，シケチイヌワラビ，イヌシケチイヌワラビ，コビトイヌワラビおよびヤクシビイヌワラビの5雑種は，細胞学的にも雑種性を示し，いずれも四倍性雑種であると推定された。ミヤマメシダとイワイヌワラビは二倍体，アリサンイヌワラビ，ヘイケイヌワラビ，シビイヌワラビ，サキモリイヌワラビ，ミドリヤマイヌワラビおよびヤクシマタニイヌワラビは四倍体であることが判明した。

2. シケチシダ属： ハコネシケチシダは三倍性雑種と推定されるが，その減数分裂時に同数の二価染色体と一価染色体を示すので，母種との間および母種間に同質倍数体の関係があるように考えられる。

3. ヤブソテツ属： ミヤコヤブソテツは無配生殖三倍体であるが，減数分裂時に三倍性胞子母細胞の他に若干の二倍性母細胞も現われる。（この二相現象はオシダ属の無配生殖種でしばしば観察されるところである。）

4. ヘラシダ属： ジャコウシダとイヨクジャクはともに両性生殖二倍体であった。

5. ミゾシダ属：品種アラゲミゾシダはその母種ミゾシダと同じ二倍体であった。

6. ミヤマシケシダ属：アソシケシダとオオメシダはいずれも両性生殖二倍体であった。オオヒメワラビは無配生殖三倍体であるが，ミヤコヤブソテツと同様に減数分裂時に二倍性と三倍性の二相母細胞を示した。したがってこの現象は，オシダ属に限らずヤブソテツ属および本属でも観察されるところから，無配生殖種の一特徴として，オシダ科全般にひろげられそうな傾向にある。

7. ヒメシダ属：オオバショリマは n=36 の二倍体，ニッコウシダは n=62 の四倍体であった。ヒメシダ属全体としてみると，基本数に関して，x=36 のものと，それからかなり離れた数として x=31 のものとの2群がある（表3,4）。マントン博士もすでに指摘しているように，この属は細胞学的にはさらに別けられるべきであるかもしれない。

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## ○アスナロの葉の奇形（森　邦彦）　Kunihiko Mori: Monstrous leaf of *Thujopsis dolabrata* Sieb. et Zucc.

ツナギガヤ（*Torreya nucifera* var. *articulata*）は，新潟県南蒲原郡田上村了玄庵境内の植栽木に現われた葉の奇形品で，天然記念物に指定されている。また同村の護摩堂山及びその附近にも，野生状態になっているものがあると言う。更に護摩堂の自生地に於ては，イヌガヤにも同様の現象が見られるとのことであるが，私は勿論この様な現象は見たことがない。御存知の様にこれは年毎の葉が表裏交互に出る奇妙な現象である。

さて，昨年7月中旬に当演習林に於て樹木学実習を行った所，或る学生の採集品の中に，植栽木アスナロの葉が一昨年のものは正常で，昨年のものは葉の裏面が表に出ており，本年のものはまた正常になっている腊葉があった。言わばツナギアスナロとも言うべきものである。毎年同じ場所でアスナロを採集をしてきたが，遂ぞ気付かずに過ぎてきた。ここで更めてアスナロにもこの現象があることを報告する次第である。尚この採集場所はアスナロの本数が多いし，積雪もある現在では調査も困難であるので，春になって該樹を探し観察してみたいと考えている。私はこの現象は一時的のものかと考えるが，資料が手近に得られたのでその成り行きを見守ってゆきたい。標本は東大に寄贈した。

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**正　　誤 (Errata)**

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